for the great faults occurring in the few papers on this part of Swiss palæontology.

The results of long researches on the Foraminifera of the Lower Malm shall be published in a short time. For the present I hope that these few remarks on the Jurassic *Trochamminæ* may be sufficient to furnish further proofs of the wide range and great variability of this interesting genus.

EXPLANATION OF PLATES III. & IV.

Figs. 1–3. *Trochammina incerta* reg.
Figs. 4, 5. *T. incerta* reg., passing into *T. incerta* irreg.
Figs. 6, 7. *T. incerta*, elliptical variety, showing the discoidal arrangement of the older convolutions.
Figs. 8–20. *T. gordialis.*
Fig. 10 *a–d.* Apertures of same.
Fig. 21. *T. charoides.*
Figs. 22, 22 *a, b. T. filum.*
Figs. 23, 24. *T. constricta.*
Fig. 25. Aperture of same.
Fig. 26. *T. constricta*, coiled up in the opposite manner, showing the last straight chamber with the small circular aperture.
Fig. 27. *T. pusilla.*
Figs. 28, 29. The same, the interior convolution hidden by finely arenaceous shell-matter.
Fig. 30. Ditto, aperture.
Fig. 30 *a.* Ditto, showing the fringe of hyaline cement.
Figs. 31–34. *T. jurassica.*
Figs. 35, 36. Ditto, with different development of the last chamber.
Figs. 37–39. Ditto.
Fig. 40. Ditto: portion of shell, with grains of sand and spicules. *a*= crystal of pyrites.
Figs. 41, 42. *Trochammina*, intermediate form between *T. constricta* and the rotaline varieties.

BIBLIOGRAPHICAL NOTICES.

A Monograph of the British Fossil Cephalopoda. Part I. *Introduction and Silurian Species.* By J. F. Blake, M.A., F.G.S., Professor of Natural Science in University College, Nottingham. 4to. London: J. Van Voorst, 1882.

This work, uniform in size and style with the Memoirs of the Palæontographical Society, will comprise a complete history of the British Palæozoic Cephalopoda, a group of Mollusca important to the geologist, which, from their distribution and varied forms, constitute a characteristic portion of the early fauna of the globe. By grants from the Government fund in aid of scientific research, the author has been able to collect materials from various museums

and private collections, and thus examine about 2000 well-characterized specimens during the progress of the work. The first part, now issued, consisting of 248 quarto pages of text and 31 plates, treats only of the Silurian species.

Commencing with the general position of the Cephalopoda in the animal kingdom, Prof. Blake treats of the chief points in which, as a class, they differ from the rest of the Glossophora, as the rudimentary condition of the foot, the partial segmentation of the ovum, and the inflexion of the intestine towards the ventral side of the body, in which latter character they agree with the Pteropoda. Although the two orders into which the Cephalopoda are divided, the Dibranchiata and Tetrabranchiata, are numerically very unequal in a living state, yet when the fossil forms are included the proportion is reversed, the greater number of the latter belonging to the second order.

As the whole of the Silurian Cephalopods, and nearly all the rest of the Palæozoic ones, are considered to be tetrabranchiate, their description is prefaced by a detailed account of the anatomy of the *Nautilus* (pp. 5–17), followed by a description (under nine heads) of the structure of the shell and the organs immediately related to it, as essentially connected with the better interpretation of the fossil forms (pp. 17–41). Of these, the septa and siphuncle are fully considered. The size and position of the siphuncle are very variable, and constitute important characters in the definition of many of the Palæozoic types, it being either simple or complex, and either ventral, median, or dorsal in position. Although there are families with non-central siphuncles, still that position is the preponderant one; for Barrande remarks that out of 1500 known forms 500 have central and 418 subcentral siphuncles.

With regard to the classification of the Cephalopoda, after discussing the views of other authors, and the position of *Bellerophon* and *Clymenia*, with which latter genus and *Goniatites* Barrande formed a third group, Prof. Blake divides the Tetrabranchiata into two suborders, Ammonitoidea and Nautiloidea.

As the former suborder is doubtfully represented in the British Silurian rocks, he proceeds to discuss the grouping of the genera of the Nautiloids, which, according to him, has not hitherto been satisfactorily accomplished. "The object is not to make a mere analytical table, without reference to the history of the group, but to show the connexion between the relations in structure and the relations in time."

The earliest and most important group is that of the Orthocerata of extreme simplicity:—(1) with a straight shell, including *Orthoceras*, *Gonioceras*, *Tretoceras*, *Endoceras*, *Actinoceras*, *Bathmoceras*, *Bactrites*; (2) with a curved shell, *Cyrtoceras* and the subgenera *Trigonoceras* and *Piloceras*. These form a natural group, and are characterized as the "Conici." The second group, more restricted in time, with slight or no curvature, more or less inflated or irregular in form, and with variously shaped apertures, is constituted by the "Inflati," and contains *Phragmoceras*, *Gomphoceras*, *Poterioceras*,

and *Ascoceras*. Thirdly we have the "Spirales," of simple form, but with great curvature, and the whorls generally in contact, except *Gyroceras*, containing *Nautilus*, *Trocholites*, *Clymenia*, &c. The members of the fourth group, having less symmetry and a more variable curvature, are associated together as the "Irregulares," including *Trochoceras*, *Lituites*, *Ophidioceras*.

Suborder NAUTILILOIDEA (having a variable siphuncle).

- Group I. *Conici*.—Curvature slight or none; form conical and regular
  - Shell straight.
    - *Orthoceras.*
    - *Endoceras.*
    - *Actinoceras.*
    - *Tretoceras.*
    - *Goniocera.*
    - *Conoceras.*
  - Shell curved.
    - *Cyrtoceras.*
    - *Piloceras.*
    - *Trigonoceras.*
- Group II. *Inflati*.—Curvature slight or none; form inflated, and irregular
  - *Poterioceras.*
  - *Gomphoceras.*
  - *Phragmoceras.*
  - *Ascoceras.*
- Group III. *Spirales*.—Curvature considerable, form simple.
  - *Trocholites.*
  - *Clymenia.*
  - *Nautilus.*
  - *Nothoceras.*
  - *Gyroceras.*
- Group IV. *Irregulares*.—Curvature considerable, but variable; form irregular or unsymmetrical
  - *Trochoceras.*
  - *Lituites.*
  - *Ophidioceras.*
  - *Cryptoceras.*

The genera belonging to the above groups are successively noticed, with their synonyms, history, description, and subdivisions as adopted by other authors or as followed in this work, and, lastly, their range in time and geographical distribution (pp. 48–68). In the same systematic manner are the species of the 17 genera and subgenera described and carefully figured, so that the student of the Palæozoic Cephalopoda may readily determine any one of the 143 species (of which 55 are new or renamed) recorded in this work (pp. 79–232). Throughout the descriptions the author has adopted a somewhat novel but excellent plan in describing actually not a species but a single type specimen (except in those referred to Bohemian forms), round which the other specimens designated by the same name are grouped as closely as they can be.

Following the type is a general description of other specimens referred to the same species, and its relation to other known British or foreign forms, and a notice of its geological and geographical distribution.

Commencing with the CONICI, the species of *Orthoceras*, about 70 in number, are arranged under two groups, of which 3 belong to the Brevicones and the remainder to the Longicones; the latter are again divided, according to external ornamentation, into *Annu-*

lati 20, *Angulati* 6, *Lineati* 13, *Imbricati* 7, and *Lœves* 22, the external surface of the latter not being fully known; then follow the subgenera, *Actinoceras* 1, *Endoceras* 3, *Tretoceras* 1, *Conoceras* 1. *Orthoceras* has its earliest representative in the Upper Tremadoc, attained its maximum in the Upper Silurian, and is well represented in subsequent periods to the Trias. The 23 species of *Cyrtoceras* are divided, according to the position of the siphuncle, into Endogastric and Exogastric (adopted from Barrande); and Prof. Blake proposes a third division, Mediogastric (Mesogastric?), with the siphuncle near the centre.

Cyrtoceras commences in the Lower Tremadoc, and is represented in the Silurian, Devonian, and Carboniferous; the subgenus *Piloceras* is of Lower Silurian and *Trigonoceras* of Carboniferous age.

Of the Inflati, *Gomphoceras* has 11 and *Phragmoceras* 7 species, all of which are chiefly Upper Silurian; the 3 species of the singular genus *Ascoceras* from the Ludlow rocks are fully described.

The Spirales are represented by 3 species of *Nautilus* from the Upper Silurian, and 3 of the subgenus *Trocholites*, of Lower Silurian (Bala) age.

The last group, Irregulares, includes *Trochoceras*, 12 species, of which 8 are Upper and 4 Lower Silurian forms; *Lituites* has 2 species from the Lower Ludlow. *Lituites articulatus*, Sow., and a new species are placed by Mr. Blake under *Ophidioceras* of Barrande, which differs from *Lituites* in having the walls in contact; the genus is only known in the Upper Silurian of England and Bohemia.

The Silurian Cephalopoda range in time from the Tremadoc beds to the Upper Ludlow tilestones, as shown in the table, pp. 233–236. Of the 143 species the greatest number (65) occur in the Lower Ludlow, 43 in the Wenlock shale, and an equal number (39) in the Bala beds and Upper Ludlow, while the Wenlock Limestone contains 35 species. In the second (condensed) table, p. 237, showing the growth, culmination, and, in some cases, the decay of the various genera or groups, and thus giving some insight into the laws which govern the appearance and disappearance of forms of life, it will be observed that the larger number belong to the Conici group, which first appear in the Lower Silurian and contain the bulk of Lower Silurian forms; but, in relation to the maxima of species, the Bala beds of the Lower and the Wenlock shale and Lower Ludlow of the Upper Silurian contain the greatest number, while, from the fact that the species in the Wenlock Limestone are fewer than in the shales either above or below, Prof. Blake infers "that the Cephalopods of those days were not commonly frequenters of clear and shallow waters, but were partly pelagic, and not uncommonly gregarious in more or less turbid waters." The Conici and Spirales continue to flourish in later periods, the *Nautilus* of the latter being now the only living representative.

The two other more or less abnormal groups, Inflati and Irregulares, although represented in the Bala beds, attained their maximum in the Ludlow period, when the whole class was most

flourishing, and then rapidly died away. From these facts Prof Blake considers that we obtain independent confirmation of laws which appear to widely govern the development of life, and may be thus stated:—"The simpler forms of a class are the first to be introduced, and the more complex appear later. It is only when the class is in its most flourishing condition, and not long before the close of a period, that it throws out the more remarkable and abnormal forms. The group which somewhat represents the mean of the whole, and never attains an extraordinary abundance, as the Spirales, is the longest to last." The different forms of shells in the Nautiloidea of the Palæozoic rocks and their apparent successive development from the straight to the curved form, the *reverse* of which succession takes place in the Mesozoic Ammonitidæ (viz. from the curved to the straight form), more than thirty years ago arrested the attention of Von Buch, who made some ingenious suggestions as to the causes which brought about the reversed conditions in the two groups (Ann. & Mag. Nat. Hist. ser. 2, vol. v. 1850, p. 382). After alluding to the various modifications which take place in the Ammonitidæ until their final disappearance in the Cretaceous strata with the Baculites, Von Buch remarks "that in the same manner as the Ammonitidæ vanish from the world, in the same manner exactly do the Nautilidæ make their appearance in the oldest. The Ammonite vanishes through a series of forms between it and the outstretched Baculite; the Nautilus, on the other hand, rises through a similar series of forms from the long-extended Orthoceratite."

It must not, however, be forgotten that, just as the straight *Orthoceras* continues contemporary with the successive appearance of the other forms in the Palæozoic rocks, so the curved Ammonite continues throughout with all the other modifications of the Ammonitidæ.

With regard to the geographical distribution of the British species as given in the table above referred to, 6 of the 143 species are found in America, and 32 are common to Europe; of these, 24 occur in the Lower Ludlow, and 18 in that and other strata.

Prof. Blake next considers the character of some genera and their appearance in time as at present known. *Cyrtoceras* first appears in the Lower Tremadoc, followed in the Upper by the *Orthoceras*, the less simple form preceding the straight one; but, says the author, the history of discovery shows that we can place but little trust in such an isolated fact, which is liable any day to be reversed. "Nevertheless, on any theory of evolution, this is just what we might expect; for the lower groups from which the Cephalopoda might be derived are not straight, like an *Orthoceras*, but curved, like a *Cyrtoceras*. Moreover we should expect, from the frequent curvature exhibited near the apex in the *Orthocerata*, that their ancestors were curved."

Another fact, in relation to the position of the siphuncle, is noticed, that the endogastric group antedates the exogastric in *Cyrtoceras*, as does the endogastric *Phragmoceras* that of the usually exogastric

Gomphoceras, and the subgenus *Trocholites*, with internal siphuncle, appears before *Nautilus*.

Prof. Blake continues some further general observations and carefully expressed views bearing on the origin and fixity of species and the theory of evolution, derived from the study of the Silurian forms, which afford a fair succession of the same class; and therefore, so long as the surrounding circumstances remain the same, the process of evolution by indefinite variation should either be uniform, or should cease when the best adaptation to these conditions had been acquired. He considers that the present study of Silurian Cephalopoda offers no contradiction or difficulty, but rather affords aid, if not as great as could be desired, yet as much as could be expected, to the general theory of evolution.

Hitherto the species of Silurian Cephalopoda were to be sought for in the different works of Murchison, M'Coy, Salter, and others; we have now, however, a monograph of the British forms, systematically arranged, carefully described, well illustrated, and replete with important observations on the structure, affinities, and modifications of the group, indicating throughout not only a great amount of labour, but of critical acumen and care displayed in the determination of the typical and varietal forms, thus supplying a much-wanted treatise on the early history of this group of Mollusca, and adding a valuable contribution to palæontological literature.

Catalogue of the Fossil Foraminifera in the British Museum (Natural History). By Prof. T. Rupert Jones, F.R.S., F.G.S., &c. 8vo. Pp. i–xxiv and pp. 1–100. London: Printed by order of the Trustees, 1882.

Following the work of Dr. H. Woodward on the British Fossil Crustacea, we have a similar Catalogue of the fossil Foraminifera in the British Museum, printed also by order of the Trustees.

This Catalogue having been prepared by Prof. T. R. Jones, one of our best authorities on this group of organisms, is a guarantee that it will form a useful work of reference to those interested in the Foraminifera, or assist them in consulting the specimens contained in the national collection. In the introduction a general sketch is given of the nature and mode of growth of the Foraminifera, including the differential character of the structure of their shells, upon which they are primarily divided into Imperforata or Porcellanea, and Perforata or Hyalina, and the former further subdivided into Calcarea and Arenacea, while some may have had limp, tough tests, consisting of material analogous to chitine, as *Ceratestina*. For so little is known of any real differentiation of the sarcode that there remain but few features of essential value for the classification of this infinitely variable order: "there are only the tissue, form, and structural peculiarities of the shell for determination; and these present many gradational phases, not only among individuals of any related group, but between the great groups themselves."